Section 2. Energy Strategic Goal / General Goal 4. Energy Security

Nuclear Energy, Science and Technology

(discretionary dollars in thousands)

	FY 2003 Comparable Approp	FY 2004 Comparable Approp	FY 2005 Congress Request	FY 2005 vs. FY 2004	
Office of Nuclear Energy, Science and Technology[a]					
University reactor fuel assistance and support	18,034	22,855	21,000	-1,855	-8.1%
Research and development					
Nuclear energy plant optimization	4,806	2,944	——	-2,944	-100.0%
Nuclear energy research initiative	17,413	6,592	——	-6,592	-100.0%
Nuclear energy technologies	31,579	19,622	10,246	-9,376	-47.8%
Generation IV nuclear energy systems initiative	16,940	27,744	30,546	+2,802	+10.1%
Nuclear hydrogen initiative	2,000	6,377	9,000	+2,623	+41.1%
Advanced fuel cycle initiative	57,292	66,713	46,254	-20,459	-30.7%
Total, Research and development	130,030	129,992	96,046	-33,946	-26.1%
Infrastructure					
Radiological facility management	62,928	63,431	69,110	+5,679	+9.0%
Idaho facilities management	62,983	75,415	108,050	+32,635	+43.3%
Idaho sitewide safeguards and security	52,560	56,343	58,103	+1,760	+3.1%
Total, Infrastructure	178,471	195,189	235,263	+40,074	+20.5%
Program direction	57,909	59,787	60,285	+498	+0.8%
Subtotal, Nuclear Energy	384,444	407,823	412,594	+4,771	+1.2%
Use of prior year balances and other adjustments	-9,003	-3,003	-3,003	——	——
Total, Nuclear Energy, Science and Technology	**375,441**	**404,820**	**409,591**	**+4,771**	**+1.2%**

[a] Includes Energy Supply and Other Defense Activities funding.

The **Office of Nuclear Energy, Science and Technology** is funded in two accounts within the Energy and Water Development Appropriation, Energy Supply and Other Defense Activities. All funding for research and development and other non-defense activities is requested within the Energy Supply account. Funding for defense related landlord activities for the Idaho National Laboratory, including Safeguards and Security, is requested within Other Defense Activities. The table above shows a summary of funding for the entire organization.

PROGRAM DESCRIPTION

The **Nuclear Energy, Science and Technology** (NE) program leads the government's efforts to: develop new nuclear energy generation technologies to meet energy and climate goals; develop advanced, proliferation-resistant nuclear fuel technologies that maximize energy from nuclear fuel; and maintain and enhance the national nuclear infrastructure. NE serves the present and future energy needs of the country by managing the safe operation and maintenance of our critical nuclear infrastructure that provides nuclear technology goods and services. A key mission of the Department's nuclear energy research and development program is to lead the U.S. and international research community in planning and conducting basic and applied research to chart the way toward the next leap in technology. The aim of these efforts and those of industry and our overseas partners, is to enable nuclear energy to fulfill its promise as a safe, advanced, inexpensive and environmentally benign approach to providing reliable energy to all of the world's people.

The programs within NE fully support **National Energy Policy** recommendations to expand the use of nuclear energy in the United States. Specifically, the **Nuclear Hydrogen Initiative** will

develop advanced technologies that can be used in tandem with next-generation nuclear energy plants to generate economic, commercial quantities of hydrogen to support a sustainable, clean energy future for the United States. The **Generation IV Nuclear Energy Systems Initiative** establishes a basis for expansive cooperation with our international partners to develop next-generation reactor and fuel cycle systems that represent a significant leap in economic performance, safety, and proliferation-resistance. Through the **Advanced Fuel Cycle Initiative,** the Department seeks to develop advanced, proliferation resistant nuclear fuel technologies that maximize the energy produced from nuclear fuel while minimizing wastes.

PROGRAM HIGHLIGHTS

The FY 2005 request supports innovative applications of nuclear technology to develop new nuclear generation technologies and advanced energy products, develop advanced proliferation-resistant nuclear fuel technologies that maximize energy output, and maintain and enhance national nuclear capabilities to meet future challenges.

The **University Reactor Infrastructure and Education Assistance** program supports the operation and upgrade of university research and training reactors; provides fellowships and scholarships to outstanding students, brings nuclear technology education to small, minority-serving institutions, and provides nuclear engineering research grants. The program helps to maintain domestic capabilities to conduct research and the critical infrastructure necessary to attract, educate, and train the next generation of scientists and engineers with expertise in nuclear energy technologies. The Nuclear Engineering Education Research program stimulates innovative research at U.S. universities. The Innovations in Nuclear Infrastructure and Education initiative continues to support six university consortiums to spur innovative collaborations that integrate academics with the operation of university research reactors. DOE also provide fresh fuel to university research reactors and supports reactor equipment upgrades at universities. Beginning in FY 2005, funding and program responsibility for transportation of domestic spent nuclear fuel shipments from university research reactors will be transferred from NE to the Office of Civilian Radioactive Waste Management (RW) to allow for a single program office to be responsible for transportation of spent fuel in the DOE complex. Also, beginning in FY 2005, funds are requested to provide fellowships and scholarships to help increase enrollment in the nation's Health Physics programs to begin addressing the serious national shortage of trained health physicists.

Beginning in FY 2005, the Department will integrate the **Nuclear Energy Research Initiative** (NERI) activity into its main research and development programs to achieve greater participation of the nation's university research community in these programs. The Department will seek universities to conduct peer-reviewed research that is focused in support of the Generation IV Nuclear Energy Systems Initiative, Advanced Fuel Cycle Initiative, Nuclear Hydrogen Initiative, and Nuclear Energy Technologies. Funding for such research projects will come directly from the budgets of the programs and will be devoted entirely to the research conducted at universities and colleges throughout the United States. The Department plans to use the bilateral I-NERI agreements that it has implemented with other nations to continue international cost-shared research and development. The restructuring will allow the Department to use all nuclear energy R&D programs as a basis for international, cost-shared research and development, and thereby significantly increase the amount of research achievable.

Under **Nuclear Energy Technologies**, the Department requests funding of $10.2 million in FY 2005 for the **Nuclear Power 2010** program to continue ongoing licensing demonstration and related analysis projects. The budgetary requirements for the program will be reviewed as Congress completes work on comprehensive energy legislation and the Department assesses the responses and requirements associated with its recent solicitation related to New Plant Licensing Demonstration Projects.

Developing next-generation nuclear systems will be an essential aspect of the **Generation IV Nuclear Energy Systems Initiative** ($30.5 million). Beginning in FY 2005, the Department puts special emphasis on the Next Generation Nuclear Plant (NGNP) as a promising Generation IV reactor technology, whose early deployment could complement the **National Hydrogen Fuel Initiative**. If successful, this technology could produce hydrogen at a cost that is competitive with gasoline and electricity as cost competitive with advanced natural gas-fired systems. Through this initiative, the United States will lead multi-national research and development projects based on the results of the internationally endorsed **Generation IV Technology Roadmap**. The international approach encourages development of widely-acceptable technologies, gives DOE access to the best expertise in the world, and leverages DOE's scarce nuclear R&D resources.

With its **Nuclear Hydrogen Initiative**, DOE will develop new technologies to generate hydrogen on a commercial scale in an economic and environmentally benign manner. DOE's Offices of Nuclear Energy, Fossil Energy, Science, and Energy Efficiency and Renewable Energy are working together to provide the technological underpinnings of the **National Hydrogen Fuel Initiative**. In the case of nuclear energy, DOE will conduct research and development into advanced thermochemical technologies that may, when used in tandem with next-generation nuclear energy systems, enable the United States to generate hydrogen at a scale and cost that would support a future hydrogen-based economy. Current fossil-fuel-based methods emit greenhouse gases and are roughly four times more costly than the market will support.

The **Advanced Fuel Cycle Initiative**, which is integral to the Generation IV Nuclear Energy Systems effort, aims to develop a better, more efficient and proliferation-resistant nuclear fuel cycle. This research and development program is focusing on methods to reduce the volume and long-term toxicity of high-level waste from spent nuclear fuel, reduce the long-term proliferation threat posed by civilian inventories of plutonium in spent fuel, and provide for proliferation-resistant technologies to recover the energy content in spent nuclear fuel.

The **Radiological Facilities Management** program maintains irreplaceable DOE nuclear technology facilities in a safe, secure, environmentally compliant and cost-effective manner to support national priorities. Beginning in FY 2005, the program funds oversight and planning to ensure that the Department's Paducah Gaseous Diffusion Plant (Paducah GDP) uranium enrichment facilities and select surplus uranium inventories are available to support future national energy security priorities and satisfy the Department's statutory responsibilities.

On May 19, 2003, oversight and landlord responsibilities for the Idaho National Environmental and Engineering Laboratory (INEEL) transferred from the Office of Environmental Management (EM) to the Office of Nuclear Energy, Science and Technology (NE). Beginning in the second quarter of FY 2005, the INEEL will be merged with Argonne National Laboratory-West (ANL-W) to create the Idaho National Laboratory (INL). The Secretary of Energy has designated INL as the center for the Department's strategic nuclear energy research and development efforts. The INL will play a lead role in Generation IV nuclear energy systems development, Advanced Fuel Cycle development, testing of naval reactor fuels and reactor core components, and space nuclear power applications.

The **Idaho Facilities Management** program provides the Idaho National Laboratory (INL) with the site-wide infrastructure required to support the laboratory's research and development programs. The INL is a multi-program national laboratory that employs its research and development assets to pursue assigned roles in a range of research and national security activities.

The **Idaho Site-Wide Safeguards and Security** program protects DOE interests from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts, which could cause unacceptable adverse impacts on national security, program continuity, the health and safety of employees, the public, or the environment at the INL.

The **Program Direction** account provides the federal staffing resources and associated costs required to provide overall direction and execution of the Department's Nuclear Energy program. In FY 2005, NE will assume full responsibility for one FTE transferred from NNSA to support the Department's interaction with the Organization for Economic Cooperation and Development (OECD). Also, seven FTE at the Oak Ridge Operations Office will transfer from the Science program to NE to oversee the Department's lease agreement with USEC, Inc., and assist in various management activities associated with the DOE enrichment sites.

SIGNIFICANT FUNDING CHANGES – FY 2004 to 2005 Request ($ in millions)

University Reactor Infrastructure and Education Assistance
(FY 2004 $22.9; FY 2005 $21.0) ..... -$1.9
In FY 2004, DOE was provided a one-time increase for spent nuclear fuel shipments; funds for this activity are not requested in FY 2005.

Nuclear Energy Research Initiative (NERI) (FY 2004 $6.6; FY 2005 $0) ..... -$6.6
Decrease reflects the restructuring to integrate NERI into the Department's mainline nuclear energy R&D programs. The competitive solicitations for NERI research will request work that is focused specifically in support of Generation IV Nuclear Energy Systems Initiative, Advanced Fuel Cycle Initiative, Nuclear Hydrogen Initiative, and Nuclear Energy Technologies. Funding for these research projects will come directly from the program's budget and be awarded exclusively to university-based researchers.

Nuclear Energy Technologies (FY 2004 $19.6; FY 2005 $10.2) ..... -$9.4
FY 2005 request for Nuclear Power 2010 will continue the Early Site Permit (ESP) demonstration projects and support NRC Review of the ESP applications for commercial sites.

Nuclear Hydrogen Initiative (FY 2004 $6.4; FY 2005 $9.0) ..... +$2.6
FY 2005 request reflects an increase to: develop thermochemical and high-temperature electrolysis hydrogen production methods; initiate targeted research, assessment, and design for alternative hydrogen production methods; and initiate preliminary design of a 200 kilowatt high-temperature electrolysis experiment and a 500 kilowatt sulfur-iodine thermochemical process experiment.

Nuclear Energy Plant Optimization (FY 2004 $2.9; FY 2005 $0) ..... -$2.9
While the Department continues to support the objectives of the NEPO program, funding is not requested for FY 2005 allowing the Department to concentrate on more long-term research and development activities on new nuclear plant designs rather than short-term activities on currently operating nuclear power plants.

Advanced Fuel Cycle Initiative (FY 2004 $66.7; FY 2005 $46.3) ..... -$20.4
Net decrease due to delaying experiments required to test Generation IV fuel forms (-$0.9), reduced level of effort on treatment of sodium-bonded fuel and advanced treatment processes (-$8.0), postponement of experiments on specific materials associated with fuel treatment (-$3.0), reduced level of effort on broad system studies, integrated fuel cycle studies and facility assessments (-$1.8), no new fellowships and research grants being awarded in FY 2005 (-$8.1) and delaying certain research and development activities into future years (-$0.5); offset by increased level of effort to complete laboratory-scale "hot" testing of advanced aqueous processes to optimize the UREX+ flowsheet (+$1.7) and complete LWR oxide fuel irradiations and post-irradiation examination (+$0.1).

Generation IV Nuclear Energy Systems Initiative
(FY 2004 $27.7; FY 2005 $30.5) ..... +$2.8
Net increase supports completion of pre-conceptual designs ($4.9) to support technology development of advanced fuels, materials and technologies; offset by decreases of $0.9 resulting from milestone delays due to a re-prioritization of activities in the Next Generation

Power Plant project within the overall Generation IV budget and $1.2 associated with delaying certain research projects into the future.

Radiological Facilities Management (FY 2004 $63.4; FY 2005 $69.1)..... +$5.7
FY 2005 request includes an overall decrease to the **Space and Defense Infrastructure** program (-$1.7). The decrease reflects early completion of building 792 modification and related site infrastructure upgrades at INL (-$5.1). The decrease is offset by the following increases to complete the installation of equipment transferred from Mound to INL and the startup of regulator assembly operations (+$0.9); operate the full scale scrap recovery line for the entire fiscal year and increase analytical chemistry costs associated with operation of the line at LNL (+$1.6); refine additional iridium scrap and upgrade and replace aging welding equipment to support iridium processing and fabrication at ORNL (+$0.9). In addition, the request includes an increase in the **Medical Isotopes Infrastructure** program (+$6.9). The increase is primarily for capital improvements to the Building 3019 Complex necessary to carryout the contract awarded in October 2003 at ORNL to support the U-233 program (+$7.8) and increases in maintenance activities for facilities at LANL, SNL and BNL (+$1.9). The increases are offset by decreases due to completing several maintenance upgrades at ORNL (-$1.5) and completing the Isotope Production Facility at LANL (-$1.3).

Idaho Facilities Management (FY 2004 $75.4; FY 2005 $108.0)..... +$32.6
FY 2005 request includes an increase for one-time costs associated with restructuring the Idaho laboratory complex and supporting infrastructure services until the new contractors are in place ($+43.8) and an increase in facility operations (+$0.7). The increases are offset primarily by a decrease for infrastructure projects at ANL-W and upgrades to the Advanced Test Reactor to support planned advanced nuclear energy research projects (-$10.6), a delay in capital equipment purchases (-$0.5), and completion of two line item construction projects in FY 2004 (-$0.8).

Idaho Site-Wide Safeguards and Security (FY 2004 $56.3; FY 2005 $58.1)..... +$1.8
FY 2005 request includes increases in physical security to support heightened security requirements resulting in increased posts, patrols, and other safeguards and security activities.

Program Direction (FY 2004 $59.8; FY 2005 $60.3) ..... +$0.5
FY 2005 request includes funding to support new hires to strengthen project management, to provide junior staff to support succession planning, and to provide for cost-of-living adjustments (+$1.1). The request also includes an increase in other related expenses due to an increase in the Working Capital Fund for the cost of building occupancy rates and an increase in telephone services (+$0.3). The increases are offset by reductions in federal staff at Idaho, Chicago, and Oakland site offices (-$0.9).